

ABSTRACT OF THE INVENTION

A semiconductor nanocrystal compound is described which is capable of linking to one or more affinity molecules. The compound comprises (1) one or more semiconductor nanocrystals capable of, in response to exposure to a first energy, providing a second energy, and (2) one or more linking agents, having a first portion linked to the one or more semiconductor nanocrystals and a second portion capable of linking to one or more affinity molecules. One or more of these semiconductor nanocrystal compounds are linked to one or more affinity molecules to form a semiconductor nanocrystal probe capable of bonding with one or more detectable substances in a material being analyzed, and capable of, in response to exposure to a first energy, providing a second energy. In one embodiment, the probe is capable of emitting electromagnetic radiation in a narrow wavelength band and/or absorbing, scattering, or diffracting energy when excited by an electromagnetic radiation source (of narrow or broad bandwidth) or a particle beam. The probe is stable to repeated exposure to energy in the presence of oxygen and/or other radicals.

Treatment of a material with the semiconductor nanocrystal probe, and subsequent exposure of this treated material to a first energy, to determine the presence of the detectable substance within the material bonded to the probe, will excite the semiconductor nanocrystal in the probe bonded to the detectable substance, causing the probe to provide a second energy signifying the presence, in the material, of the detectable substance bonded to the semiconductor nanocrystal probe. In one embodiment, the semiconductor nanocrystals in the probe are excitable over a broad bandwidth of energy, and emit electromagnetic radiation over a narrow bandwidth, making it possible to use a single energy source to simultaneously excite a plurality of such probes, each emitting electromagnetic radiation of a differing wavelength band to simultaneously analyze for a plurality of detectable substances in a material being analyzed.

Also described are processes for respectively making the semiconductor nanocrystal compound and the semiconductor nanocrystal probe. Processes are also described for treating materials with the probe, for example, to determine the presence of a detectable substance in the material bonded to the probe.